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# Outbreaks of Waterborne Disease in the United States, 1978

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16. ABSTRACT

Surveillance of outbreaks of waterborne disease is jointly conducted by the Center for Disease Control (CDC), Atlanta, Ga., and the Environmental Protection Agency (EPA), Cincinnati, Ohio. Waterborne outbreaks are reported to the CDC and EPA by state and local health departments and by water supply agencies, and the data are tabulated annually. In 1978 more cases of waterborne disease were reported than in any year since surveillance was initiated in 1971, and for the first time, two agents, Campylobacter fetus subspecies jejuni and a Norwalk-like virus, were well documented as causes of waterborne disease outbreaks. This report summarizes reported outbreaks of disease related to drinking water that occurred in the United States in 1978.

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# NEWS

## From the Center for Disease Control

### Outbreaks of Waterborne Disease in the United States, 1978

Surveillance of outbreaks of waterborne disease is jointly conducted by the Center for Disease Control (CDC), Atlanta, Ga., and the Environmental Protection Agency (EPA), Cincinnati, Ohio. Waterborne outbreaks are reported to the CDC and EPA by state and local health departments and by water supply agencies, and the data are tabulated annually [1–4]. In 1978 more cases of waterborne disease were reported than in any year since surveillance was initiated in 1971, and for the first time, two agents, *Campylobacter fetus* subspecies *jejuni* and a Norwalk-like virus, were well documented as causes of waterborne disease outbreaks. This report summarizes reported outbreaks of disease related to drinking water that occurred in the United States in 1978.

An outbreak of waterborne disease is defined as an incident in which (*1*) two or more persons experienced similar illness after consumption of water and (*2*) epidemiologic evidence implicated the water as the source of illness. In addition, a single case of chemical poisoning constitutes an outbreak when laboratory studies indicate that the water is contaminated by that chemical.

For the purpose of analysis, the water systems are classified as community, noncommunity, or individual in accordance with the definitions set forth in the Safe Drinking Water Act (PL 93–523) of 1974. A community water system (previously referred to as municipal) is defined as one that serves at least 15 service connections used by year-round residents or that regularly serves at least 25 year-round residents. A noncommunity water system (previously referred to as semipublic) is one to which the public has access but which does not satisfy the criteria for a community system. Examples of noncommunity systems are those located in camps, parks, and institutions. Individual systems supply one or a few residences and usually derive water from wells or springs.

We thank the State and Territorial Epidemiologists and Laboratory Directors, the State Environmental Health Directors, the State Water Supply Agencies, and the other public health officials who investigated and reported waterborne disease outbreaks to the Center for Disease Control and the Environmental Protection Agency programs.

Please address requests for reprints to Dr. Charles E. Haley, Water-Related Diseases Activity, Enteric Diseases Branch, Bacterial Diseases Division, Bureau of Epidemiology, Center for Disease Control, Atlanta, Georgia 30333.

#### Outbreaks

In 1978, 32 outbreaks of acute waterborne disease involving 11,435 cases were reported to the CDC and EPA. Although the total number of reported outbreaks has declined slightly from the 35 and 34 outbreaks reported in 1976 and 1977, respectively [5, 6], the total number of cases involved is the highest in the eight years since initiation of the surveillance system. Eighteen states reported at least one outbreak in 1978 (figure 1), with Pennsylvania accounting for the largest number of outbreaks (seven of 32 [21%]). In 16 (50%) of the 1978 outbreaks, the etiology was determined (table 1): *Shigella* accounted for four outbreaks, *Giardia lamblia* for four, Norwalk-like agents for three, *Salmonella* for two, chemicals for two, and *C. fetus* subspecies *jejuni* for one. In contrast, in 1976–1977, the etiology was identified in only 23 (33%) outbreaks [5, 6]. The illness in the 16 outbreaks of undetermined etiology was characterized by upper or lower gastrointestinal symptoms and, in most instances, by an incubation period of 12–48 hr. A bacterial etiology was sought in 14 of the 16 outbreaks of unknown etiology, and stool specimens were submitted for viral studies in five.

In three of the four largest outbreaks, an etiologic agent was found. A community water system in Colorado was implicated in an outbreak of giardiasis (5,000 cases), an estimated 3,000 people were infected with *C. fetus* subspecies *jejuni* in an outbreak in Vermont traced to a community water supply, and a noncommunity water supply

**Figure 1.** Outbreaks of waterborne disease in the United States in 1978.

in a school in Washington was implicated in an outbreak due to a Norwalk-like agent (467 cases).

The majority of outbreaks (18, or 56%) involved noncommunity water supplies; nine (50%) of these were caused by use of untreated water (table 1). Twelve (67%) of the implicated noncommunity systems were in recreational areas such as campgrounds and resorts. Community water supplies accounted for only 10 (31%) of all outbreaks but for 77% of the people affected. Treatment deficiencies were responsible for six of these 10 outbreaks. Individual water supplies accounted for four (13%) of the outbreaks but only 0.3% of the cases.

## Discussion

The 32 outbreaks in 1978 and the annual average of 34 outbreaks reported in the period 1976–1978 represent an increase over the five-year average of 24 outbreaks for 1971–1975. The increasing number of reported outbreaks of waterborne

**Table 1.** Outbreaks of waterborne disease by etiology, type of water system, and system deficiency in 1978.

| | Types of water system | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Community | | Noncommunity | | Individual | | Total | |
| Disease or system deficiency | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases |
| Disease | | | | | | | | |
| Acute gastrointestinal illness | 3 | 511 | 10 | 1,490 | 3 | 13 | 16 | 2,014 |
| Giardiasis | 2 | 5,130 | 1 | 23 | 1 | 18 | 4 | 5,171 |
| Shigellosis | 2 | 56 | 2 | 122 | 0 | 0 | 4 | 178 |
| Parvovirus-like agent illness | 0 | 0 | 3 | 937 | 0 | 0 | 3 | 937 |
| Salmonellosis | 1 | 78 | 1 | 11 | 0 | 0 | 2 | 89 |
| Chemical poisoning | 1 | 12 | 1 | 34 | 0 | 0 | 2 | 46 |
| Campylobacteriosis | 1 | 3,000 | 0 | 0 | 0 | 0 | 1 | 3,000 |
| Total | 10 | 8,787 | 18 | 2,617 | 4 | 31 | 32 | 11,435 |
| System deficiency | | | | | | | | |
| Treatment deficiencies | 6 | 8,404 | 4 | 536 | 0 | 0 | 10 | 8,940 |
| Untreated ground water | 1 | 34 | 8 | 1,432 | 1 | 5 | 10 | 1,471 |
| Deficiencies in distribution system | 3 | 349 | 4 | 603 | 0 | 0 | 7 | 952 |
| Untreated surface water | 0 | 0 | 1 | 23 | 2 | 8 | 3 | 31 |
| Miscellaneous | 0 | 0 | 1 | 23 | 1 | 18 | 2 | 41 |
| Total | 10 | 8,787 | 18 | 2,617 | 4 | 31 | 32 | 11,435 |

disease in recent years is probably primarily the result of more active surveillance in certain states. The totals given here are estimated to be but a fraction of the outbreaks that occurred.

Water systems used on a seasonal basis, such as those in camps, parks, and resorts, are subject to extreme demands as a result of many visitors during specific periods and, in some instances, are overused. For the most part these are noncommunity systems. Water systems in such areas, especially campgrounds and parks, must be reappraised and monitored, and corrections must be made to ensure the continued provision of safe water under seasonally increased demands. Only with thorough investigation will major deficiencies commonly affecting these systems be understood and corrected. The large outbreaks that occurred in 1975 in Crater Lake National Park [7] and in 1977 in Yellowstone National Park [8] underscore the problems that occur with water supplies in recreational areas.

Quantitation of coliform and fecal coliform organisms, a standard indicator of microbiologic contamination, is routinely used by regulatory agencies in surveillance of drinking water. Negative results have usually been interpreted as providing assurance that the water is free of enteric pathogens. This interpretation must be reevaluated in recognition of data available from waterborne outbreaks of giardiasis in which coliform contamination of the water could not be documented [9]. Although results of coliform and fecal coliform tests frequently provide evidence of contamination in outbreaks, it is important that an attempt also be made to isolate pathogens from a water system during an outbreak to help establish the etiology and to provide additional supportive evidence that the outbreak was waterborne.

A large outbreak of gastroenteritis caused by *C. fetus* subspecies *jejuni* occurred in Vermont in May and June 1978 [10]. The primary water source of the city was surface water that was chlorinated but not filtered. Two auxiliary sources of surface water, neither of which was chlorinated, were used to supplement system output and to prevent low pressure in the distribution system. One of these sources had not been used since February 1978; the other was activated automatically when pressure was low. Records showed that throughout the outbreak period, water samples from several areas of the town had no residual chlorine. Epidemiologic investigation clearly implicated drinking water as the vehicle of transmission, but routine coliform analyses performed during and after the outbreak gave negative results.

Many of the outbreaks of waterborne disease that are termed "acute gastrointestinal illness of unknown etiology" or "sewage poisoning" have been thought to be caused by viral agents based on the clinical features of the illness and the average incubation period of 24–48 hr. However, in many instances the investigation was not initiated until long after the outbreak had occurred, thus precluding timely collection of specimens for determination of etiology. Newer laboratory methods, such as immune electron microscopy and radioimmunoassay, and volunteer studies have made it possible to identify parvovirus-like agents responsible for outbreaks of waterborne disease. The agent responsible for one outbreak of unknown etiology that occurred in 1976 has recently been confirmed as a parvovirus-like agent that is antigenically distinct from the Norwalk agent [11]. Three outbreaks in 1978 were also caused by parvovirus-like agents (two in Pennsylvania and one in Washington were caused by a Norwalk-like agent), an observation suggesting that parvovirus-like agents may be the cause of many of the waterborne outbreaks of gastrointestinal illness that have previously been classified as of unknown etiology. Inadequately chlorinated noncommunity supplies were implicated in two outbreaks caused by Norwalk-like agents and a deficiency in the distribution system was implicated in one. Fecal coliform contamination of the water supply was evident in all three incidents.

Identification of the etiologic agent in outbreaks of waterborne disease caused by parvovirus-like agents is dependent upon the timely collection of proper specimens. A large volume of stool (≥10 g) should be collected from at least six to 10 acutely ill patients during the first 48 hr of illness and frozen at −70 C until studied; acute- and convalescent-phase serum specimens should also be obtained. Similar specimens should be collected from healthy control individuals.

In the future the proportion of outbreaks of unknown etiology should decrease if public health authorities are promptly notified when a waterborne outbreak of illness is suspected so that

thorough epidemiologic and laboratory investigation using recently developed laboratory techniques can be conducted and the water system thoroughly evaluated to determine how contamination occurred. Sampling techniques that process large volumes of water for detection of pathogens have been developed for use in outbreak investigations.

Individuals who identify a possible outbreak of waterborne disease are requested to report it promptly to local and state health authorities. The Water-Related Diseases Activity at the CDC and Health Effects Research Laboratory at the EPA are prepared to provide epidemiologic, laboratory, and engineering assistance to health departments in the investigation of suspected outbreaks of waterborne disease.

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